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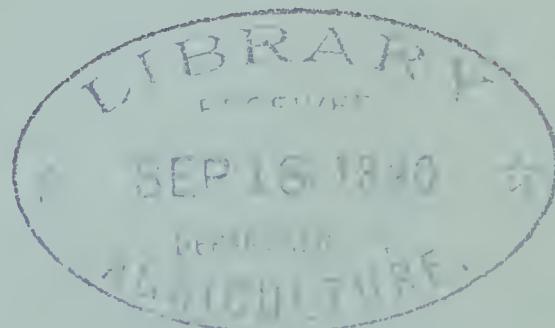
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[*From the 'TRANSACTIONS OF THE HERTFORDSHIRE NATURAL HISTORY SOCIETY,' Vol. II, Part 1, August, 1882.]*



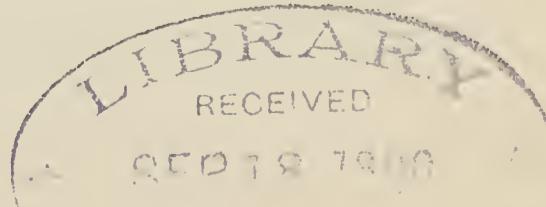
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ON METHODS OF PREVENTION OF INSECT-INJURY.

By ELEANOR A. ORMEROD, F.M.S.

AMONGST the various methods by which the attacks of injurious insects to our crops may be prevented or remedied, none are so sure as those that are based on natural principles, together with broad measures of cultivation, that is to say, on taking advantage of such peculiarities in the habits of the so-called pests as may afford points at which they are open to attack; and secondly, though in a lesser degree, we may utilize peculiarities in their nature which are affected by meteorological influence, or, in other words, by the weather. It is frequently remarked that "we cannot alter the weather,"—but this is not quite the case, for drainage and irrigation on a large scale have effect on atmospheric conditions, and may be brought also to bear as means of prevention of attack of serviceable practical use to the field crops, much more than they are at present. We also find that by observing the way in which continued sunshine and drought, or on the other hand long wet weather, or sudden and violent rainfall in a dry season, affect various kinds of insects most destructive to our crops, we may follow the lesson up practically by artificial means to our own great advantage.

Similarly amongst our forest or orchard trees, although we cannot have sunshine at command, we may often expose a much larger surface to its influence, and thus act at once on a broad scale on some of the injurious insects with much more effect and less cost than by any local applications, such as dressings, washings, or other remedies.



In considering the question of insect-attacks on our food-crops, and to a certain extent on our fruit, it is of some importance to remember that we are very often, if not for the most part, dealing with plants that are in some way or other in an abnormal state—in an unnatural condition as regards their own vegetable development; or the numbers in which they are grown together; or the soil they grow in. The object of cultivation is frequently to produce an increased development of some particular part, as for instance the enlarged succulent mass which forms the so-called bulb of the turnip, and the mass of close-pressed leafage of the “hearted” cabbage. A greater amount of fruit-cultivation also produces the aggregation of one kind of plant unnaturally over many acres, sometimes (as may be seen especially in the cultivation of cabbage in what is known as “garden-farming”) without due rotation of crops.

With an increase of population it is necessary to increase our vegetable supplies, but the great increase of the insect-pests from the unavoidable massing together of food-plants which in their natural state would be thinly scattered amongst other kinds, either not infested by the same insects or deterrent to them, is one special point. Where there are only a few plants together of a kind, whether they are killed or not by the insect-attack, the attack itself either dies out for want of food, or is not propagated to any great extent, but where a space of many acres is covered by one crop, if any insect-pest that produces many generations in one season once gets hold, it has everything at hand for continuance.

Before entering on these points a little in detail, it may be of interest to quote the account given in Holinshed's ‘Chronicles,’ of the variation in the amount of vegetables cultivated in this country which was observable in a general view of a period of about three hundred years before the date of 1586. The extract is given from the Chapter entitled “Of Gardens and Orchards” in the 1st volume of the ‘Chronicles.’

“Such herbs, fruits, and roots also as grow yearly out of the ground, of seed, have been very plentiful in this land, in the time of the first Edward and after his days: but in process of time they grew also to be neglected, so that from Henry the Fourth till the latter end of Henry the Seventh, and beginning of Henry the Eighth, there was little or no use of them in England, but they remained either unknown, or supposed as food more meet for hogs and savage beasts to feed upon than mankind. Whereas in my time their use is not only resumed among the poor commons, I mean of melons, pompions, gourds, cucumbers, skirrets, parsneps, carrots, cabbages, navews, turnips, and all kind of salad-herbs, but also fed on as dainty dishes,” etc.

In our own days the quantity of food-crops is enormously increased; and as a matter of course there is an increase of the insect-feeders on these crops, but the amount of this increase depends on many circumstances or coincidences. Regarding some of these we have gained solid practical knowledge—long-continued

drought for instance, or sudden heavy rainfall after dry hot weather, —or long-continued rainfall affecting the state of plant-health, and the state of the ground, all have effects that we understand and can work on, but there is a great deal as to the reasons for insect-appearance in large or small quantities that as yet we have not got the clue to, and it is this variable amount of attack that makes the great difficulty in calling in the aid of what may be considered our first natural helpers, the insectivorous birds. There is no doubt that keeping up what is called the average amount is desirable, and in fact necessary ; but when we come to inviting a large increase in numbers, or to the introduction of species which either for variety, or in emergency, are partially graminivorous in their diet, it is to be feared that we may be doing ourselves a mischief. So long as there is a great amount of insect-presence, so long do the extra number of these birds of mixed diet help us, but failing the insect-food they are very apt to prey on the crops instead, and may turn out a still greater evil.

It would be a great help for practical purposes, if we had a short account in plain form of the habits and the diet in ordinary circumstances and emergencies of our common insectivorous birds, together with the localities which they frequent. Many feed partially on insects, or, as the description often runs, "on insects, worms, and slugs," but it would be very useful to know which kinds in time of scarcity make up their scanty meals from our crops, and which turn to animal matter such as mice or the smaller Mammalia, carrion or offal, small fish, and the shell-fish of our ponds and streams, or the animal life of the sea-shore. Some of the gregarious birds that frequent both the sea-shore and the estuaries of our larger rivers are useful by coming occasionally, and when attracted by a great amount of insect-presence, far inland, but not burdening us with their keep when not serving us. Several kinds of sea-gulls are thus of use by following the plough on land infested with large grubs, especially those of the cockchafer; and I have notes sent in this year of the serviceableness of the black-headed gull, *Larus ridibundus* (sometimes known as the Scoulton gull), in destroying caterpillars and various kinds of moths during a bad attack on the oaks at Tullamore, King's County, Ireland.

The lapwing, which frequents marshy places as well as wild heaths and hill-sides, helps us by feeding on insects in their various stages, and was notably useful last year in the attacks of the larvae of the daddy-long-legs, or *Tipulæ*.

Starlings also will most conveniently undertake, so to say, a temporary piece of work, such as clearing saw-fly larvae, and though in default of insect-food they will eat berries or grain, and are sometimes injurious from the vast numbers in which they collect bearing down their roosting-places, yet near the sea-shore they will turn in times of scarcity to the supplies of animal food that they can gather on the beach.

The insectivorous night or twilight fliers, such as the tawny owl and the night-jar, are very serviceable ; so also is the cuckoo,

by clearing off hairy larvæ; and many others would probably be utilized much more if we had some short account to show the many amongst us who are not practical Ornithologists the points where they help us, and also in cases of unusually large appearance of birds, as of titmice brought together by aphis-presence, rooks searching for grubs in the pastures, sea-gulls, starlings, or others, how to be able to distinguish between friends and foes, or species which are devoting themselves temporarily to good service.

Where there is a great amount of insect-attack, or where it may reasonably be supposed that insect-presence is doing harm although unseen, there the aggregation of birds should by all means be protected; but as a general thing the amount to which the insectivorous birds should be encouraged and increased beyond the natural balance, is a very difficult subject. It is often overlooked that these insectivora feed on the *insect-parasites* of our insect-pests as well as on the pests themselves, and consequently kill our allies as well as our enemies. This point is brought forward in the Report of the Agricultural Commission of Ontario, a work replete with useful information and suggestion, and deserves serious consideration. Various kinds of parasitic Hymenoptera are of such service in keeping down the caterpillars of various pests, as for instance the maggots of the ichneumon flies which hold the cabbage-butterfly in some sort of check, that their special protection and multiplication is advised; and not to go too much into detail, we may refer to ladybirds that keep down the aphides, dipterous flies that also serve us, and many other species. All these have their uses, and we should soon feel the want of them.

Other kinds of insect-feeders have their uses also, such as the mole, the bat, the shrew, and even the squirrel, in destroying the "cased" larvæ and pupæ of the pine saw-fly; but nevertheless it seems to me that any movement to decidedly increase the number of the insect-destroyers beyond the natural balance is not *certainly* desirable.

Of course when attack is present any means of getting rid of it is useful, and a great deal may often be done by working on *some one special habit*, which may frequently be found to exist in very different kinds of insects, and different stages of their lives. For instance various kinds of beetles, as cockchafers and weevils, also the caterpillars of various kinds of moths and sawflies, fall to the ground if their food-plant is shaken; and if we look at the large class of injury caused to leafage by these pests, we shall find that much good might be done by simply shaking or gently striking the infested boughs or small trees.

This is a regular part of German forestry or gardening; in America "jarring" the trees is equally looked to as a means of getting rid of the pests, and in the case of our vegetable crops also there are agricultural methods of carrying out the plan, and it may safely be advised whenever any plant (or tree of a size to which the plan is applicable) is infested, to try immediately what effect a good shaking, syringing, or *careful* beating will have in clearing

the vermin, of course taking measures to prevent those that drop down from returning again. Where the ground is bare, merely giving it a good trampling will destroy large numbers of fallen caterpillars, and if a ring of gas-lime is just thrown with a spade round the trunk of the tree, of course not touching it in case of the gas-lime being fresh, all regress is stopped.

Beating on to large cloths is a good plan with the wingless beetles, such as some weevils, which thus may be destroyed in large numbers at night; and in large attacks of beetles, such for instance as cockchafers, which lie for a short time on the ground and then take wing, some assistants, such as poultry, or better still, pigs, whose energy is unbounded in the service, are invaluable in completing the operation.

Again, looking at general methods of treatment, where the ground has been occupied by infested crops, thorough digging, trenching, or ploughing (of which the details would be too tedious to enter on here) which would turn some part of the soil so deeply down that the contained vermin, whether as perfect insects, chrysalids, larvæ, or eggs, could trouble us no further, and would throw part on the surface to the birds, or other agents of destruction, would all be useful; and besides the mitigation of evil we may get by reasonable general treatment, the more we examine into the life-histories of our commonly injurious crop-pests, the more we find that there is usually some point at which the injury they do lies open to special measures of prevention—literally a point where we may be before-hand with it.

Dressings and washings, and other applications, require much knowledge in the applicant to make them serviceable, and often only add to the expenses of the attack. For instance, in the case of turnip-fly, or flea-beetle, the dustings which are applied on a dry hot day, or even on a dewless late evening, or early morning, may probably be only a loss of so much money for labour and material per acre, whilst if applied when there was moisture and the leaping legs of the flea-beetle were so clogged therewith that it could not spring away, the dusting would take effect, first by falling on it before it had skipped out of reach, next by sticking to it, to its great injury.

Similarly with aphides—many of them have an exterior of a nature that repels all merely fluid washes, and often a mere watery wash runs off from them as from a duck's back, and unless it lodges amongst the crannies formed by their aggregated numbers, or poisons their food, they remain unharmed,—whilst if something adhesive, as soft soap, is added, the application remains and has due effect.

It is in points of this nature that the agriculturists of the United States of America, also of Ontario, and possibly of other Canadian States, have such a great advantage over ourselves. The great mass of practical information published by the Entomological Department of the United States Government gives a large amount that is intelligible to general readers as to the life-histories and

habits of the insects, and much that is valuable regarding practicable remedies, whilst the communications being from many correspondents in different circumstances of soil and climate, a variety of methods of attack on the pest, suitable for various conditions, is furnished.

In the course of last year the Congress of Vienna drew attention, under the name of Agricultural and Forest Meteorology, to the importance of attending to the connexion that might be worked out between conditions of weather and states of vegetation, and whatever *may* be worked out on this head regarding crops and trees, there *is* plainly shown, by a glance over the agricultural returns of this country extending over many years, to be such coincidence in certain states of the weather, and the appearance, either immediately or subsequently, of some of our crop-pests, that the subject well deserves our own careful attention.

We know how turnip-fly and drought appear in connexion, also how the attack of daddy-long-legs (which perhaps I should rather mention as that of larvæ of different kinds of *Tipulæ*) is increased by wet conditions, and was thus strongly brought to our notice after the long rainfall of 1879.

How these various meteorological states act on insect-life we know something about in many cases, though we ought to understand a great deal more; but as I fear to infringe too long on your time, I should like now to be permitted merely to draw attention, by one example somewhat in detail, to the great benefit we may receive by artificially copying in treatment the lesson that we may learn from special weather-effects.

Taking an example from the apple-orchard, observations on the apple-weevil, *Anthonomus pomorum*, show that the amount of attack is very much influenced by the nature of the weather in the spring, which affects the duration of the period during which the beetle can deposit its eggs, and also the suitableness of the blossom-buds as food for the larvæ when hatched.

This beetle is a small brownish weevil, about the eighth of an inch in length, with some transverse markings of whitish and pitchy colour on the wing-cases, and it begins its work early in the year. As soon as the blossom-buds are sufficiently advanced for its purpose, the female weevil pierces with her rostrum or snout through the still-closed bud into the parts of fructification, and lays her eggs slowly one by one in different buds, so that, if circumstances are favourable, she will occupy as much as three weeks in the task. She cannot commence the operation till the buds are well formed, and she discontinues it immediately the petals begin to unfold; consequently the duration of her laying-time depends very much on the state of the weather, and if the opening of the flower-buds is rapid, egg-laying is correspondingly cut short.

The same influences act on the young larvæ—they require protection from rain and sunshine, and therefore such an amount of sunshine as unfolds the petals of the bud is injurious to their development, and very beneficial to our crop of apples.

As examples of these effects of weather, it is stated by Schmidberger that in 1816 the apple-buds were attacked for nearly three weeks, "because the cold fog and rain checked the progress of the sap already in motion, and therefore the buds, which were already swollen out, were for several days prevented from unfolding, and scarcely a blossom was found that was not pierced." That year there was no apple-crop. In 1817 the sap did not begin to flow until nearly the end of April, and on the 16th of May the apple-trees were in full flower; laying time was thus cut short and the blossom was beautiful.

It is also mentioned by John Curtis that these little beetles sometimes occasion great loss to the grower, "especially in cider counties in backward seasons," and here it seems to me that we get to the point where the lesson learned from weather-influences may be applied. In our cider counties there are tracts beautifully managed, but also localities where, sometimes from neglect, sometimes from mis-applying the view that "trees bear best on their upper surface," the orchards are so thickly planted that the trees meet, or grow into each other so completely that the top is *nothing but* surface, as far as flowers are concerned. Perhaps some of the members present may have stood on the chief mound of the old Roman Station of Caerwent, the Venta Silurum of Antonine's 'Itinerary,' about six miles from Chepstow, and looked down during the month of May on the surrounding orchards in what has been well described as "a sea of blossom." It is a sight of no common beauty from above; but passing beneath this flood of bloom, I found, when I knew the locality, the precise state of things produced artificially which Curtis' and Schmidberger's observations show is congenial to the apple-weevil. Here, and in the many localities where trees are allowed to run up together so that direct sunshine, and also free play of air under the trees and amongst the boughs, is too much shut out, the buds on the lower branches in the shaded parts come on slowly, and thus lengthen out the blossoming-season during which they are available to the weevil for egg-laying. We imitate the state of things produced by wet cloudy weather, whilst if the trees were kept in healthy progress in the sun and air, we should be much less at the mercy of the weevils, and also the army of apple-tree vermin such as American-blight aphis, scale-insect, and many others, which thrive, or are hidden from observation, and so get a-head in such spots. The effect of heavy rainfall after heat and drought in destroying some kinds of caterpillars has long been known, and whether this occurs from the external effect of the moisture or from causing a sudden flow of dilute sap unwholesome to the creature, does not as yet seem clear; but the same effect might be brought about to a serviceable amount at least in garden-cultivation. Other meteorological influences may also be imitated.

Whatever good we may gain from the many different kinds of treatment which may be necessary for forestalling or keeping down insect-attack, *one point is incontrovertibly of immense importance,*

and that is by *every means*, whether by preparation of the ground, draining, manuring, proper thinning of the crops, pruning of the trees, or in whatever way we can manage it, to *promote healthy growth*. The crop that is run healthily through germination, and makes way rapidly in a kindly soil, is by no means *certainly* preserved in case of bad attacks, but in case of the moderate amount usually to be expected, the field of plants making (say) their *two* inches of growth per diem to counterbalance a loss of (say) one inch by insect-ravage, will hold on whilst the field of stunted growth that does not replace damage is lost; and whatever may happen in the occasional visitations of destroying legions, or with some pests whose attacks are especially difficult to meet, it may safely be laid down that whether in farm or garden, one most serviceable means of prevention of attack is *good cultivation*.

We must moreover all feel that prevention of loss which involves yearly what cannot be estimated at less than hundreds of thousands of pounds worth of the daily food of the nation, is a matter of vital importance both to growers and consumers.
